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CHAPTER 8

The Diffusion of Business Cycles

Geoffrey H. Moore

BUSINESS cycles have long been recognized as fluctuations that are in some sense general or pervasive. Business cycle theories explain how and why expansions or contractions spread from one firm to another, from one industry to another, or from one region or country to another. They also show why prices, wages, profits, employment, production, sales, inventories, interest rates, savings, and other factors react upon one another and hence rise or decline more or less together. They go on to explain how increases in some factors can, at about the same time or with a lag, induce contractions in others. In short, business cycle theories lead one to expect cyclical movements to be diffused throughout the economy; a widely diffused expansion gives way to a general contraction, to be followed once more by a general expansion, and so on.[1] In recent years investigators at the National Bureau of Economic Research have developed new measures of the diffusion of cyclical movements, and have shown that they may be useful in judging the economic prospects of the nation. Some of the highlights of these results are considered in this paper:

If we are to measure the diffusion or pervasiveness of business cycles we must decide, first, what sectors or aspects of the economy we are to consider, and second, how to record the changes in activity in the sectors. With regard to the first point, two possible approaches suggest themselves. One is to take a wide variety of economic factors, such as those mentioned above, and measure diffusion by determining how widespread is the participation of these factors in a given cyclical movement. Such an approach can take account of the fact that many aspects of the economy are apparently relevant to the generation of business cycles.

NOTE: Reprinted from *Economics and the Public Interest*, Robert A. Solo, ed., copyright by Rutgers University Press, New Brunswick, 1955, pp. 35–38. The appendix to the original paper is not reprinted here since its contents are largely duplicated in Volume II.

This paper is based in part on the published and unpublished results of investigations carried on for many years at the National Bureau of Economic Research by Arthur F. Burns, Wesley C. Mitchell, and others; and in part on a study undertaken during the past year [1954] by Phillip Cagan, Harry Eisenpress, Millard Hastay, and the author. The business cycles computing unit at the National Bureau, directed by Sophie Sakowitz, has carried out the statistical analysis. We are indebted to the Board of Governors of the Federal Reserve System and to the Bureau of Labor Statistics for their generous aid in supplying some of the tabulations used in this study.

[1] For one of the first but still one of the best accounts of this cumulative process, see Wesley C. Mitchell's *Business Cycles*, Berkeley, 1913, Part III, which was reprinted as *Business Cycles and Their Causes*, Berkeley, 1941.

An upswing can be brought about and kept going by developments in any of a wide variety of sectors, and by countless combinations of them; unless one keeps this wide variety in view something essential may be missed. On the other hand, figures on production, prices, profits, etc., cannot be simply added up into a meaningful aggregate, and there is no well-established criterion as to what is relevant and what is not, or how the various factors should be weighted. The other approach meets this difficulty. Some comprehensive index or aggregate, such as industrial production, an index of wholesale prices, or total corporate profits, can be decomposed into significant components, and the diffusion of a cyclical movement among the latter measured. If need be, the components can be appropriately weighted. Here too, however, we face a multitude of choices, for there are many ways in which national aggregates can be subdivided—by geographic region, by industry, by individual firm—and there are many aggregates to choose from.

Fortunately, there is no need to choose one, and only one, approach to this problem. The business cycle analyst is interested in how a cyclical movement spreads across the country, how it spreads from one industry to another, how it spreads among different economic processes. Whether we construct a measure of diffusion from the components of well-defined economic aggregates or from groups of series that have some special analytic significance, we deal with materials among which there are causal interconnections. We cannot expect any single measure to tell us all that we want to know, and it makes sense therefore to examine a number of them.

Basically, the measures of diffusion that we shall consider are very simple. They register in percentage form how many industries, for example, are experiencing an increase in output at any given time, and how many are experiencing a decline. We call the percentage expanding (or contracting) a diffusion index. These indexes take into account only the direction, not the magnitudes of change. And although some experiments with weighting the component series (industries or firms) by their "importance" have been conducted, we present only unweighted indexes.[2]

[2] Under certain conditions a diffusion index based on the components of an aggregate, such as total employment, bears a simple relationship to the rate of change (first differences) in the aggregate. The month-to-month change in total employment, for example, is the algebraic sum of the month-to-month changes in employment in the component industries. If these changes were all of equal absolute size and remained constant over time, their algebraic sum would be proportionate to the excess of the percentage expanding over 50 per cent (or to the difference between the percentage expanding and the percentage contracting). If, instead, the changes are strictly proportionate to the size of the industry (i.e. if the per cent changes in employment in terms of the industry size as base are the same for each industry), and if the diffusion index is computed by expressing the aggregate employment in expanding industries as a percentage of the total (i.e. by weighting the expanding industries by their size), the same relationship holds. Hence under these conditions if the excess of the percentage expanding over 50 per cent were

We shall, however, present indexes that utilize different methods of identifying the direction of change in the components. Some have special merit only suitable for historical analysis. Others can be brought "up to date" month by month. The several methods will be described as we proceed.

The scope of a business cycle expansion or contraction typically varies as the expansion or contraction unfolds. The nature of this variation in diffusion *within a cycle* was disclosed by Wesley Mitchell in his last work.[3] In Part II of this book Mitchell analyzes the average or typical behavior during business cycles of some 794 time series relating to economic activities in the United States. Dividing each of the business cycles covered by a series into nine stages, he determines from the eight intervals between these stages those during which the series typically expands and those during which it typically contracts. Not quite half the series, he finds, typically rise from the trough stage to the peak stage of the cycle, and fall again to the trough stage. About 5 per cent move in precisely the opposite fashion. About 10 per cent move so irregularly in relation to business cycles that they could not be considered to exhibit any characteristic timing. The remaining series, more than 40 per cent of the sample, typically reach peaks or troughs at stages other than those designated as peak or trough stages in general business activity.

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cumulated from month to month the resulting "aggregate" would faithfully follow the course of the true aggregate, and vice versa.

Because industries differ in size and in the extent of their relative changes, and vary in both respects over time, no such simple relationship holds in practice. Moreover, we have assumed that the diffusion index is computed from month-to-month directions of change in each of the component series. When different intervals are used for different components the arithmetic of the relation of the diffusion index to the aggregate becomes much more complicated. Nevertheless, a diffusion index, however computed, may well be correlated with the rate of change in the aggregate. Conceivably, the path followed by the diffusion index could be smoother and more "cyclical" than that followed by the rate of change in the aggregate. In this event the variation in the diffusion index might "account" for a large proportion of the *cyclical* variation in the aggregate. There is some evidence that this is often the case.

The relation between diffusion indexes based on components of aggregates to the aggregate itself has been used, apparently with considerable success, to estimate the aggregate. See O. Anderson, Jr., "The Business Test of the IFO-Institute for Economic Research, Munich, and Its Theoretical Model," *Review of the International Statistical Institute*, 1952, No. 1, pp. 1–17; and H. Theil, "On the Time Shape of Economic Micro-variables and the Munich Business Test," *ibid.*, No. 2/3. However, our studies of diffusion have, for the most part, had a different objective, namely, to consider the "scope" of a cyclical expansion or contraction as a variable of interest in its own right, and to explore its behavior and significance. Since measures of diffusion are not limited to types that bear a simple arithmetic relation to rates of change in aggregates, and since in any case the arithmetic relations do not establish what the empirical relations are, it does not appear that a "short cut" to the above objective can be taken by confining attention to rates of change in aggregates.

[3] *What Happens during Business Cycles: A Progress Report*, New York, NBER, 1951.

These results imply that "business cycles consist not only of roughly synchronous expansions in many activities, followed by roughly synchronous contractions in a slightly smaller number; they consist also of numerous contractions while expansion is dominant, and numerous expansions while contraction is dominant."[4] Indeed, the scope or diffusion of expansion and contraction varies rather systematically from stage to stage, as the percentages in Table 8.1 show. The first set of observations in the table summarizes the behavior of the 794 series just described, indicating that the scope of expansion increases as the expansion proceeds but diminishes before it ends; that this diminution in the scope of expansion continues for a time in the contraction phase as the scope of the contraction increases; but that the scope of the contraction also diminishes before it ends.

When the sample is restricted to thirty-four series each of which represents, in as comprehensive a fashion as possible, some important aspect of economic activity, the results change somewhat.[5] Column 2 is constructed like column 1 in that the entries are based on the characteristic timing of the series. Column 3 is based, not on a judgment of the characteristic timing, but on the actual average pattern of behavior of each of the thirty-four series during the business cycles it covers. Some of these averages are based on as many as twenty-one cycles, some on as few as three; most cover at least ten. All told some 400 cycles are covered by the thirty-four series. When we take the pattern for each individual cycle as a separate observation, we obtain the results in column 4.

Although columns 2, 3, and 4 differ in detail, all confirm the showing of the 794 series to the effect that there is a diminution of the scope of expansion toward its end, and a diminution of the scope of contraction toward *its* end. This is also confirmed by column 5, which is restricted to series of one type only, factory employment, and to a fixed period, the four business cycles between 1921 and 1938. Column 5 is like column 4 in that each cycle is counted as one observation, but in column 5 each series gets the same weight because they all cover the same four cycles.

Some variation appears in the table in the stage when the expansion or contraction is most widely diffused. In columns 1 and 5 expansion is most general between the middle and last third; in columns 2, 3, and 4 it is most general in the initial stage. Participation in contraction is widest at its start, according to columns 2 and 3; and in the next stage or the one following, according to columns 1, 4, and 5. Apparently, depending on what activities are considered and how they are measured, expansions or contractions may or may not spread further once they have become general. But the five sets of observations are unanimous in stating that

[4] *Ibid.*, p. 79.
[5] *Ibid.*, pp. 256f.

TABLE 8.1

Five Sets of Observations on Diffusion of Movements in Economic Data During Successive Stages of Business Cycles

Stage of Business Cycle	*Entries Based on Characteristic Cyclical Timing of:* *794 Series*[a] Per Cent That Rise	Fall	*34 "Comprehensive" Series*[b] Per Cent That Rise	Fall	*Entries Based on Change in Av. Reference Cycle Standings of 34 "Comprehensive" Series*[c] Per Cent That Rise	Fall	*Entries Based on Changes in Reference Cycle Standings During 400 Cycles Covered by 34 "Comprehensive" Series*[c] Per Cent That Rise	Fall	*Entries Based on Changes in Reference Cycle Standings During 84 Cycles Covered by 21 Factory Employment Series*[c] Per Cent That Rise	Fall
	(1)		(2)		(3)		(4)		(5)	
Expansion:										
Trough to first third	79	21	91	9	94	6	86	14	67	33
First to middle third	82	18	88	12	85	15	79	21	70	30
Middle to last third	84	16	85	15	88	12	74	26	79	21
Last third to peak	74	26	71	29	75	25	67	33	74	26
Contraction:										
Peak to first third	27	73	9	91	9	91	30	70	33	67
First to middle third	18	82	12	88	18	82	29	71	18	82
Middle to last third	18	82	12	88	12	88	29	71	17	83
Last third to trough	32	68	47	53	44	56	47	53	21	79

SOURCE: Columns 1 to 4, W. C. Mitchell, *What Happens during Business Cycles: A Progress Report*, pp. 52, 307; column 5, A. F. Burns, "Economic Research and the Keynesian Thinking of Our Times," reprinted in *The Frontiers of Economic Knowledge*, p. 21.

[a] It is assumed that half of the 84.5 series (10.6 per cent of the sample) that move irregularly during business cycles rise during each segment and the other half fall.

[b] It is assumed that one of the two series that move irregularly during business cycles rises during each segment and the other falls.

[c] Entries of "no change" are split half and half between "rise" and "fall."

expansions or contractions become less general before they reverse themselves.

The five sets also declare unanimously that the gradual changes in the scope of expansion or contraction *during* the phase become swift at the peak and at the trough. For example, column 1 shows that although the percentage of series that typically rise diminishes from 84 to 74 between the third and fourth segment of expansion, it drops to 27 as soon as the peak is passed. Similarly, the minority of series that are rising grows from 18 to 32 per cent at the end of contraction, but quickly becomes a substantial majority (79 per cent) when the trough is passed. Diffusion indexes evidently exhibit particularly marked changes in the vicinity of business cycle peaks and troughs. This is a direct consequence of the fact that cyclical peaks and troughs in economic time series are not scattered at random through time, but are concentrated around certain dates, the dates designated as business cycle peaks or troughs.

Table 8.1 is constructed in such a way that the data for each business cycle are forced into the same mold, with eight observations on the changes in activity during each cycle, no matter what its length. The first "third" of expansion has sometimes been only three months long, sometimes as long as sixteen months; contractions have been even more variable: the first "third" has on occasion been as short as two months but in one case it lasted twenty-one months. Moreover, the scheme is suited only to historical study, for one cannot divide an expansion or contraction phase into "thirds" until the phase is completed (although, following a suggestion of Mitchell's, one might conceivably take some recent date as a tentative peak or trough and construct a tentative pattern for comparative purposes). Finally, the table does not tell us how consistently the pattern of diffusion holds from cycle to cycle. These deficiencies are overcome in Charts 8.1 and 8.2, where several diffusion indexes are plotted month by month (in one case quarterly) during each of several business cycles.

The top curve (A) in both charts was constructed by Arthur F. Burns from virtually the same sample of 800-odd series that Mitchell used, although for various reasons fewer series enter into the curve at any one point. Except for the first year and a half of the period the number of series covered exceeds 600 every month. In constructing Curve A, a series was said to expand in any given month if that month was situated between a cyclical trough and a cyclical peak in the series, and to contract during the interval from a cyclical peak to a cyclical trough.[6] These "specific cycle" peaks and troughs were determined by careful study of the entire series and application of appropriate criteria for identifying

[6] However, series that typically conform invertedly to business cycles, for example business failures and certain types of inventories, were treated invertedly. This procedure was also used in Curves H through M in Charts 8.1 and 8.2, but not in the other curves or in Table 8.1.

cycles. The remaining curves in Chart 8.1 were constructed in a similar manner.[7]

Curve A clearly depicts the same type of pattern observed in Table 8.1, a pattern that is repeated with some variations in every cycle. The scope of expansion or contraction diminishes toward the end of the phase, and the shift is particularly rapid in the vicinity of the business cycle peak or trough. Although the time, within an expansion or contraction, when the scope of the expansion or contraction is at a maximum varies considerably from cycle to cycle (see dots in the chart), this point seldom occurs less than six months or more than twelve months before the turn in aggregate activity (Table 8.2).

Curves B to G in Chart 8.1 reveal the fact that cyclical movements become diffused in very similar fashion in such economic variables as production, employment, profits, payrolls, prices, and new orders for investment goods. In all these processes revival begins while contraction is still dominant; expanding activities eventually outweigh contracting activities and continue to spread for a time; but a check to the increasing scope of expansion inevitably appears, and before long contraction becomes dominant again, encompassing an ever larger fraction of the economy before giving way to a new revival. These sequences are recurrent but not periodic. They seem to appear no matter what broad aspect of economic activity one examines, and the variations in the pattern from one cycle to another found in one group of activities are reflected more or less faithfully in other groups.

Some systematic variations in the timing of these waves do appear, however. The check to expansion and to contraction seems to occur especially early in corporate profits and in new orders for investment goods, two factors that traditionally have been thought to be closely connected with each other and with the generation of business cycles. The peaks and troughs in the percentage of companies with expanding profits (Table 8.2, section 1) precede the corresponding turns in the production diffusion index in seven instances, coincide in one, and lag behind in one. The turns in profits invariably precede those in employment and payrolls, and precede those in wholesale prices in six instances, falling behind in two, and coinciding in one. But profits and new orders show roughly parallel behavior, with profits leading new orders at three turns, lagging at three, and coinciding at three. Hence the turns in new orders, like profits, almost always come before those in production,

[7] The procedure for identifying cycles is described in Burns and Mitchell, *Measuring Business Cycles*, pp. 56–66. For a fuller description of Curves A, B, C, E, and G in Chart 8.1, see A. F. Burns "New Facts on Business Cycles" (reprinted here, Chapter 2). Curve D was constructed by Thor Hultgren and described in *Cyclical Diversities in the Fortunes of Industrial Corporations* (reprinted here, Chapter 11). Curves H, K, L, and M are analyzed in Moore's *Statistical Indicators of Cyclical Revivals and Recessions* (reprinted here, Chapter 7).

CHART 8.1

Diffusion Indexes Based on Specific Cycles, 1919–38

Part I

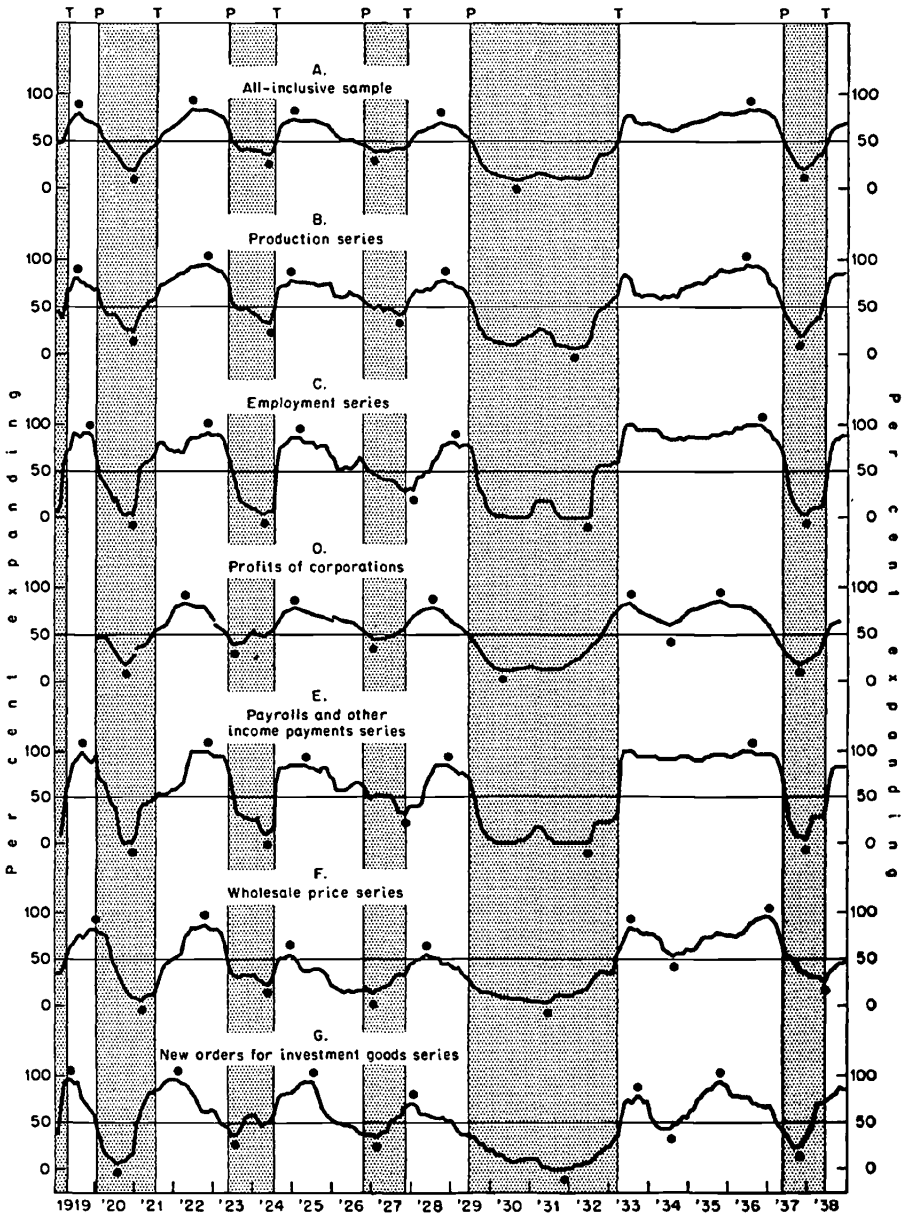
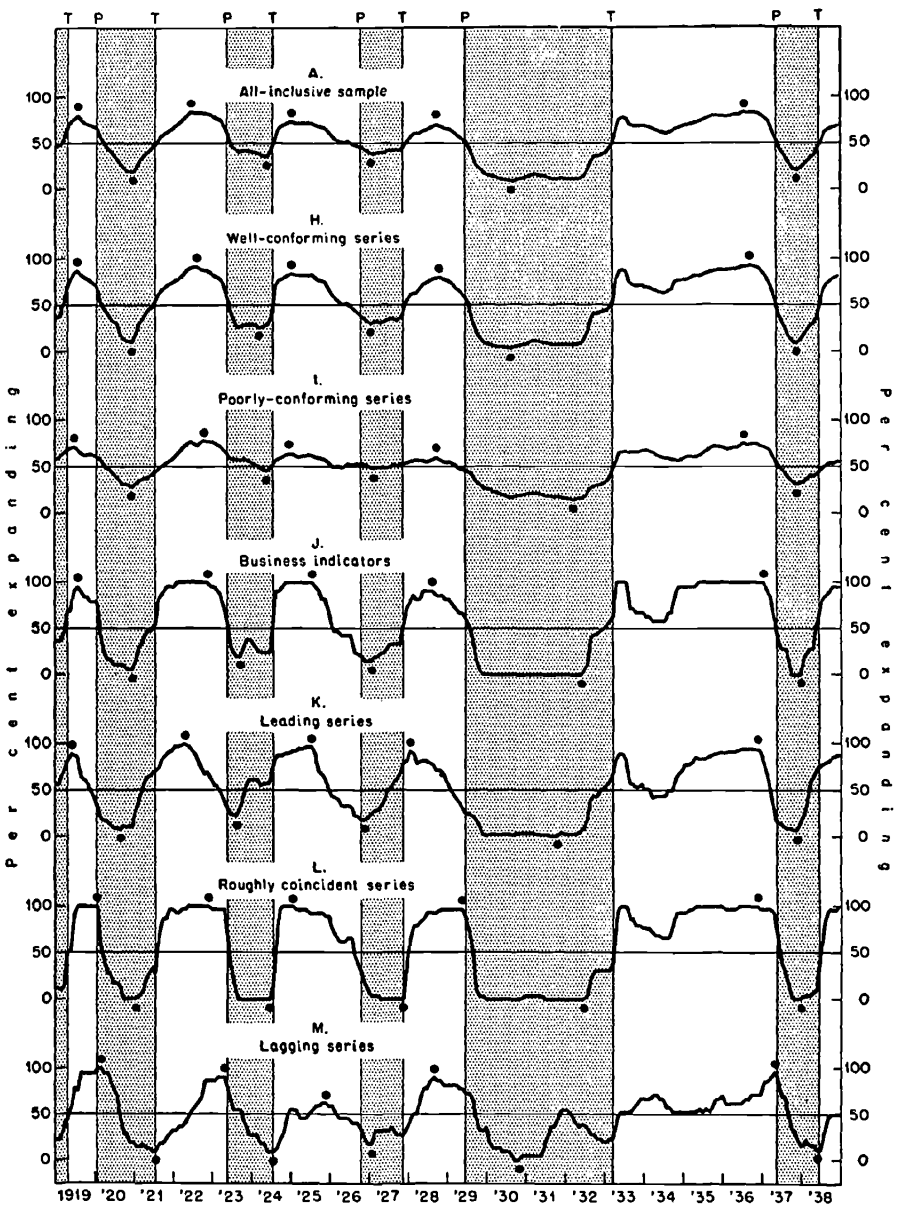


CHART 8.1 (concluded)

Part II



See Volume II for description of content of diffusion indexes. Shaded areas represent business cycle contractions; unshaded areas, expansions. Dots identify peaks and troughs of specific cycles in the diffusion indexes.

CHART 8.2

Diffusion Indexes Based on Short-Period Directions of Change, 1919–38, 1947–54

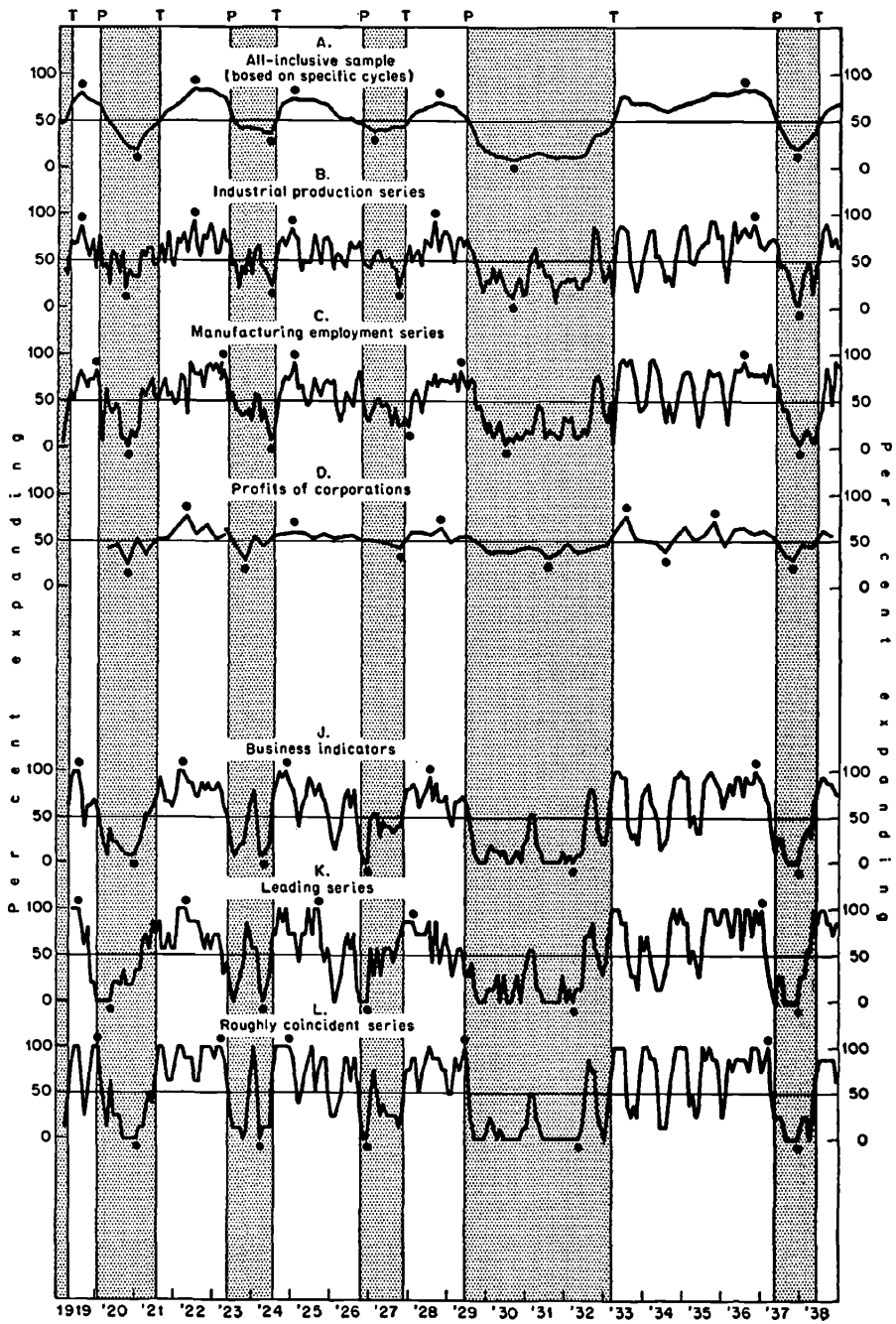
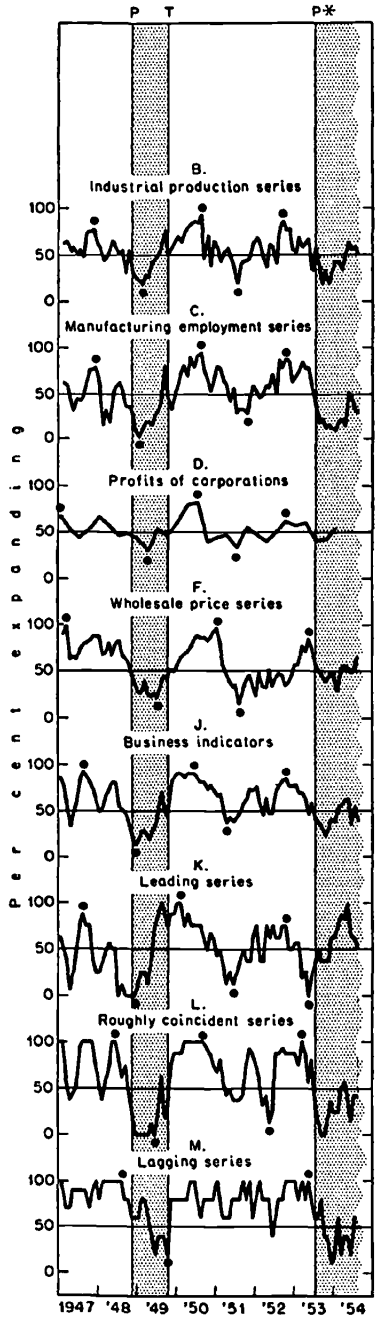


CHART 8.2 (concluded)



See Volume II for description of content of diffusion indexes. Shaded areas represent business cycle contractions; unshaded areas, expansions. Dots identify peaks and troughs of specific cycles in the diffusion indexes.

* Tentative peak.

TABLE 8.2

Timing of Diffusion Indexes at Business Cycle Peaks and Troughs, 1919-38, 1948-53

		Lead (−) or Lag (+) in Months													*Number of Leads*				*Timing Relative to All-Inclusive Sample*		
		P Jan. 1920	T July 1921	P May 1923	T July 1924	P Oct. 1926	T Nov. 1927	P June 1929	T Mar. 1933	P May 1937	T June 1938	P Nov. 1948	T Oct. 1949	P July 1953	Average Lead or Lag (months)	Less Than 6 Mos.	6 to 12 Mos.	More Than 12 Mos.	Number of Leads	Coin.	Lags
	1. INDEXES BASED ON SPECIFIC CYCLES																				
A	All-inclusive sample (D 58.0)	−6	−7	−11	−2	−21	−10	−9	−31	−10	−7				−11.4	1	7	2	—	—	—
B	Production series (D 15.1)	−6	−7	−6	−1	−22	−2	−7	−13	−11	−8				−8.3	2	6	2	3	2	5
C	Employment series (D 13.2)	−2	−7	−6	−3	−19	+2	−4	−9	−6	−6				−6.0	4	5	1	1	1	8
D	Profits of corporations (D 9.1)		−9	−13	−12	−21	−10	−11	−35	−19	−8				−15.3	0	5	4	7	2	0
E	Payrolls and other income payment series (D 19.2)	−4	−7	−6	−2	−17	0	−6	−9	−9	−6				−6.6	3	6	1	0	2	8
F	Wholesale price series (D 21.1)	.0	−4	−7	−2	−22	−10	−13	−21	−4	0				−8.3	5	2	3	2	2	6
G	New orders for investment goods series (D 6.2)	−8	−12	−15	−12	−15	−9	−17	−16	−19	−8				−13.1	0	5	5	7	0	3
H	Well-conforming series (D 55.0)	−6	−7	−9	−4	−21	−10	−8	−31	−8	−7				−11.1	1	7	2	1	6	3
I	Poorly conforming series (D 56.0)	−7	−7	−7	−2	−22	−9	−9	−12	−10	−7				−9.2	1	8	1	2	5	3
J	Business indicators	−6	−7	−6	−10	−15	−10	−10	−10	−4	−6				−8.4	1	8	1	2	3	5
K	Leading series (D 50.3)	−8	−11	−13	−11	−15	−12	−17	−17	−6	−7				−11.7	0	6	4	6	1	3
L	Roughly coincident series (D 51.3)	0	−6	−6	−1	−21	0	−1	−9	−6	−6				−5.6	4	5	1	0	1	9
M	Lagging series (D 52.1)	+1	0	−1	0	−11	−10	−10	−29	−1	−1				−6.2	6	3	1	1	1	8
	2. INDEXES BASED ON SHORT-PERIOD DIRECTIONS OF CHANGE																				
B	Indus. production series (D 15.0)	−6	−10	−11	−1	−22	−2	−10	−31	−7	−6	−12	−8	−10	−10.5	2	9	2	3	3	4
C	Manufacturing employment series (D 13.1)	−1	−9	−2	−1	−21	+1	−2	−33	−10	−6	−11	−9	−9	−8.6	5	6	2	2	2	6
D	Profits of corporations (D 9.0)		−9	−13	−9	−21	−1	−8	−20	−19	−8	−22	−6	−9	−12.1	1	6	5	5	1	3
F	Wholesale price series (D 21.0)											−20	−3	−2	−8.3	2	0	1			
J	Business indicators (D 54.0)	−6	−7	−14	−3	−23	−11	−11	−12	−6	−6	−15	−10	−9	−10.2	1	9	3	5	2	3
K	Leading series (D 50.0)	−6	−14	−13	−3	−13	−11	−16	−12	−4	−6	−15	−10	−9	−10.2	2	6	5	5	1	4
L	Roughly coincident series (D 51.0)	0	−6	−2	−4	−22	−11	0	−10	−2	−6	−5	−4	−4	−5.8	8	4	1	3	0	7
M	Lagging series (D 52.0)											−3	0	−2	−1.7	3	0	0			

SOURCE: See Volume II, for content of diffusion indexes identified by serial numbers. Business cycle peak and trough dates correspond to those in Appendix A except that here the unrevised June 1929 peak is used and the peak of February 1945 and trough of October 1945 are omitted.

employment, and payrolls. Production reacts more promptly than employment or payrolls, leading both employment and payrolls at seven turns, coinciding twice, and lagging once. Payrolls turn sooner than employment in four instances, lag twice, and coincide four times. As for production and wholesale prices no systematic tendency appears, since production leads at four turns, lags at five, and coincides at one.

Curves H to M in Chart 8.1 are based on groups of time series that are homogeneous, not with respect to the type of economic activity they represent, but with respect to some aspect of their cyclical behavior. The all-inclusive sample is divided into two parts to produce Curves H and I. Curve H includes only those series that conform in a highly regular fashion to business cycles, Curve I the remaining series, which are of a very different economic character. The diffusion indexes for both, however, conform well to the cycle and their timing is very similar too. One of the important differences between them will be considered below.

Curve J, the twenty-one business indicators, is based in effect on a highly restricted sample of well-conforming series. For this reason it moves closer to the extremes of 100 and zero than Curve H. But its timing is similar to that of Curve H, or indeed, Curve A.

Curves K, L, and M indicate how diffusion indexes behave when their components are restricted to series that move with similar timing in the business cycle. Curve K includes only series that typically lead, hence its own timing reveals especially long leads. Its behavior is notably like that of new orders for investment goods; indeed, a substantial proportion of the series that comprise it are of this type (see appendix to Chapter 7). Curve L includes only series that generally reach peaks or troughs within a few months of the peak or trough in general business activity. Broad indexes of production, transportation, and employment figure prominently in it. Hence it moves rapidly from the 100 per cent line to the zero line in the vicinity of a business cycle peak, and promptly back toward the 100 per cent line when a cyclical trough is reached. Curve M records the movements of series that tend to lag. Interest rates, certain price series, and payrolls are among the series comprising this group. Frequently expansion is most prominent in these series just when contraction is beginning to dominate the behavior of most others, and vice versa. In six instances the peak or trough in Curve M came within one month of the business cycle peak or trough; in the other four instances they came earlier.

Although I cannot deal with the matter in this paper, I believe that the behavior of diffusion indexes such as these can and should be woven into a general theory of business cycles, for they represent an important aspect of the process whereby business cycles are generated. The fact that in the later stages of an expansion, while the aggregate profits of all

corporations are still expanding, the percentage of corporations with rising profits begins to decline must have important effects on the prospects for further exploitation of profitable opportunities, on the way men judge these prospects, and on the commitments they make upon these judgments. Commitments for new investment begin to be checked at this early stage in the expansion: the number of industries with expanding new orders begins to decline, although the aggregate volume of commitments continues to grow. The check to commitments soon affects output, and the number of industries with rising output begins to decline. Similar changes take place in employment, prices, and payrolls. These developments all reinforce and react upon one another. The declines in profits spread to more and more firms and with increasing speed. When there are about as many firms with declining as with rising profits, aggregate profits reach a peak and begin to fall. So does aggregate new investment, output, employment, payrolls, and indexes of prices, though not all at once and not always in the same sequence. The general expansion comes to an end and a general contraction begins.

Obviously, this is the barest sketch of what happens; other variables, such as interest rates, cost factors, retail trade, inventories, etc., must be considered. But even the simple diffusion indexes in our chart demonstrate the significant fact that cyclical developments take *time*. Expansions wax and wane, and so do contractions. Moreover, while expansions in some processes are waxing, in others they have already begun to wane. That is why the all-inclusive sample (Curve A) seldom registered expansions in more than 80 per cent or less than 20 per cent of its components in any month during 1919–39. The task of identifying the participants in this grand procession, and developing a reasoned account of their actions and interactions, was the task that Wesley Mitchell's epic investigation undertook, a task he had to leave "for later times and other hands."

Although the diffusion indexes in Chart 8.1 permit month-by-month study of cyclical developments during 1919–39, the procedure used cannot readily be applied to the construction of a diffusion index on a current basis, because of the difficulty of determining cyclical turning points in the component series currently. Chart 8.2 shows the results of some experiments with indexes that can be kept "up to date." Curves B, C, D, and F simply record, respectively, the proportion of production series (industries or products), employment series (industries), profits series (companies), or price series (commodity groups) that rose from the previous month or quarter. In Curves J, K, L, and M moving averages are applied to the individual series (business indicators) and directions of change are determined from the centered moving averages. Each of these curves is far more erratic than its counterpart in Chart 8.1, and

shows some shorter swings that may be confused with the broader swings corresponding to business cycles. But the broad swings can still be traced and their timing recorded (Table 8.2, section 2).

It is evident from Chart 8.2 and Table 8.2 that diffusion indexes having some of the interesting properties of those based on historically identified cycles can be constructed on a current basis, and that they have continued to exhibit these properties in recent years. The peaks and troughs in the index (Curve J) based on short-period directions of change in business indicators, for example, virtually all occur within a month or two of the turns in the all-inclusive sample (Curve A). The index comprised of "leading" series (K) reached peaks and troughs usually in advance of the index constructed from "roughly coincident" series (L) or "lagging" series (M). In Chart 8.2 as in Chart 8.1 the production index (B) usually moved earlier than the employment index (C): it led the latter in eight instances, lagged three times, and coincided twice. The profits index (D) in Chart 8.2, however, does not show as persistent a tendency to lead as its counterpart in Chart 8.1: the profits curves in the two charts reach coincident turns in five cases, but the index based on quarter-to-quarter changes lags behind the other at the remaining four turns. This may be an accident; the only other corresponding curves in Charts 8.1 and 8.2 that differ substantially in timing are the leading series curves (K), where the Chart 8.2 curve lags behind the Chart 8.1 curve in eight instances, coincides once, and leads once. But here, in contrast to the profits indexes, there are more substantial differences in the number and type of series included.

Despite the broad similarity between the indexes in Charts 8.1 and 8.2, the more erratic nature of those in Chart 8.2 puts difficulties in the way of the observer who wishes to interpret them month by month. The price for obtaining a current diffusion index is greater uncertainty about its cyclical movements. Although we have discovered no escape from this dilemma, various compromises can be made. Curves based on month-to-month changes, like B, C, D, and F, can be smoothed by moving averages; or their components can be smoothed first, as in Curves J, K, L, and M. In either case, since the moving averages must be centered, they cannot be brought strictly up to date. But some sacrifice in this respect is desirable if it enables us to discern the economic swings of longer run significance.

In the course of testing the validity of the National Bureau's chronology of business cycle peaks and troughs, Burns and Mitchell observed that the more severe contractions and more vigorous expansions tended to be more widely diffused than the milder phases.[8] They did not

[8] *Measuring Business Cycles*, p. 106.

TABLE 8.3

Diffusion Indexes Based on Specific Cycles, in Mild and Severe Contractions

	Business Cycle Contraction[a]					Rank Correlation Coefficient, Diffusion and Amplitude
	June 1929 to March 1933	May 1937 to June 1938	Jan. 1920 to July 1921	May 1923 to July 1924	Oct. 1926 to Nov. 1927	
Amplitude of contraction[b] (%)	75	45	35	22	9	
Indicated peak in aggregate activity (all-inclusive sample)[c]	June 1929	May 1937	Mar. 1920	June 1923	July 1926	
Third month following peak	Sep. 1929	Aug. 1937	June 1920	Sep. 1923	Oct. 1926	
DIFFUSION INDEXES, THIRD MONTH FOLLOWING PEAK: PERCENTAGE CONTRACTING						
All-inclusive sample	71	69	62	59	53	+1.0
Production series	72	69	58	51	43	+1.0
Employment series	71	82	81	82	39	+.2
Corporate profits series	64	77	64	59	45	+.8
Payrolls & other income payments series	74	83	59	69	37	+.8
Wholesale price series	81	49	52	68	83	−.4
New orders for investment goods series	72	78	90	55	62	+.5
Well-conforming series	77	78	67	73	61	+.8
Poorly conforming series	65	60	56	44	45	+.9
Business indicators	86	76	90	81	81	+.2
Leading series	80	91	90	68	82	+.2
Roughly coincident series	90	76	83	100	72	+.3
Lagging series	55	45	20	45	68	−.2

SOURCE: See Table 8.2.

[a] Peak and trough dates from Appendix A, except that here the unrevised June 1929 peak is used.

[b] See appendix to Chapter 3, Table 3.6.

[c] Date when percentage expanding declined to approximately 50 per cent.

speculate on whether a contraction was severe because it was widespread, or whether it was widespread because it was severe. The interaction among economic processes is such that the relationship must run both ways. Nevertheless, Burns later observed one characteristic of the diffusion index, Curve A, that seemed to imply that the scope of a contraction shortly after it began had a significant bearing on its ultimate severity.[9] Table 8.3 shows that three months after Curve A (the all-inclusive sample) indicated a peak in aggregate activity (by crossing below 50 per cent) it had reached a level in each contraction that was closely associated with the ultimate severity of the contraction as measured by its amplitude from peak to trough. The striking character of this result is demonstrated by comparison with other well-known measures of aggregate activity. Whereas between June and September 1929 the percentage of series undergoing contraction in Burns' all-inclusive sample rose from 48 to 71 per cent, aggregate industrial production declined by only 1 per cent and factory employment did not decline at all. Changes in these aggregates in corresponding intervals in the other business cycle contractions bear little or no relationship to the severity of the impending depressions.

Table 8.3 also shows that when the comprehensive sample of series used to construct Curve A is divided into series that conform consistently and those that conform less regularly to business cycles, series of the former type impart a high degree of sensitivity to Curve A, while series of the latter type contribute especially to its power to discriminate between severe and mild contractions. That is, in all but one contraction more than two-thirds of the well-conforming series were undergoing contraction within three months after the contraction began (dating its beginning from the first month that 50 per cent or more of the series in the comprehensive sample were contracting). The poorly conforming series did not reach this degree of unanimity by this date in any of the contractions. But they were more nearly unanimous, even at this early stage, in the severe than in the mild contractions, and differentiated the one from the other more accurately, on the whole, than the well-conforming group.

We do not yet know the full meaning of this discriminating power of poorly conforming series. Perhaps it simply reflects the influence of severe contractions in general business activity on processes that, because they are dominated by long-run growth trends or by short-run factors that are relatively independent of the domestic business situation, do not regularly participate in the swings in the aggregate volume of business. But if so, why should the influence be observable so early in the contraction, when the magnitude of the change in aggregate activity is barely discernible? Does it mean that severe contractions are the *resultant* of an

[9] "Business Cycle Research and the Needs of Our Times," reprinted in *The Frontiers of Economic Knowledge*, Princeton for NBER, 1954, p. 180.

extraordinary conjuncture, in which activities that do not ordinarily keep in step with one another or with aggregate activity happen to be "in phase" at the onset of what might otherwise be a mild contraction? In any event, until we can establish an explanation, it seems wise to heed Wesley Mitchell's counsel:[10]

> Writers who form their concepts or "models" of business cycles without careful study of actual processes are prone to overlook the sectors of the economy that do not regularly expand and contract in unison. It might be argued that irregular series have no share in the cyclical tides and that omitting them from consideration is a proper simplification of the theorist's task. One who wishes to deal with actual cycles cannot accept such a view. Surely the behavior of the activities that expand and contract in unison would be other than it is if farming followed the timing of steel, if all inventories were either positive or inverted, if the prices of no commodities or services were "sticky," and if governments used all their construction projects as a balance wheel to moderate fluctuations in employment. Successive business cycles would differ less from one another than they do if these cyclical recalcitrants could be brought into line.

Returning to Table 8.3 we see that diffusion indexes for production, observed at the same early recession dates, bear a close relationship to the severity of the contractions. The relationship shown by the diffusion index for corporate profits and payrolls is fair, but that for the remaining indexes is virtually nil. Nevertheless, it is significant that all but two of the indexes in the table (price and "lagging" series) show *some* positive relationship, as indicated by the rank correlation coefficients.

Probably the variation among the several indexes in their apparent ability to detect severe contractions at an early date is due, in part, to variations in the mixture of well-conforming and poorly conforming series that they contain. The business indicators were, of course, especially selected for the regularity of their conformity to business cycles; this makes them especially sensitive to recessions in the economy, as the high percentages contracting in Table 8.3 testify, but seems to reduce their power, at least when used in a diffusion index, to discriminate between severe and mild contractions. Perhaps the poor showing of the employment series has a similar explanation, since employment series typically exhibit high conformity.[11] But payrolls series also conform well, and prices not so well; conformity alone cannot account for all the puzzles in the table.

Since Table 8.2 showed that some diffusion indexes tend to move

[10] *What Happens during Business Cycles: A Progress Report*, p. 60.
[11] Cf. *Ibid.*, p. 92.

earlier than others, it is of interest to test the value of the early movers at an earlier date than used in Table 8.3. If we take this earlier date to be the peak month, instead of three months after the peak, the results, for the three indexes that frequently led the all-inclusive sample are:

	Percentage Contracting		
Indicated Peak All-Inclusive Sample	*Corporate Profits Series*	*New Orders for Investment Goods*	*Leading Series*
June 1929	49	64	75
May 1937	64	62	84
March 1920	53	81	82
June 1923	56	62	75
July 1926	37	55	68
	Rank Correlation Coefficient, Diffusion and Amplitude		
	+.3	+.6	+.6

The performance of profits on this basis is not as good as in Table 8.3; new orders and the leading series do somewhat better, though not sufficiently to warrant much satisfaction.

The diffusion indexes whose standings are recorded in Table 8.3 depend on the identification of cyclical turns in their component series. This is one reason why it is too early to claim that such indexes have *predictive* significance. For the identification of cyclical turns may be crucial to the construction of an index that has the properties demonstrated in Table 8.3. In other words, it may not be possible to construct an index with these properties unless one can distinguish, without benefit of hindsight, the *cyclical* from all the other inconsequential swings that economic time series undergo.

In Curves J, K, L, and M of Chart 8.2, short-term moving averages are used to eliminate some of these noncyclical reversals. In Curves B, C, D, and F no effort is made to eliminate them—all reversals in the monthly or quarterly data are counted. Table 8.4 puts these indexes to the test. We find that none of them performs as well as the best performers in Table 8.3, and even the best result in Table 8.4 is not especially good. But there is at least a broad similarity between the results in the two tables: all the correlation coefficients between diffusion and amplitude in Table 8.4 are positive, just as are those for the corresponding indexes in Table 8.3.

Table 8.4, therefore, provides only a faint hope that diffusion indexes constructed in these ways will provide reliable indications of the severity of impending depressions. Results of experiments with a wider range of

TABLE 8.4

Diffusion Indexes Based on Short-Period Directions of Change, in Mild and Severe Contractions

Amplitude of Contraction[a] (per cent)	Date	Industrial Production[b] Series	Manufacturing Employment Series	Corporate Profits Series	Business Indicators	Leading Series	Roughly Coincident Series
	PERCENTAGE CONTRACTING: THIRD MONTH FOLLOWING INDICATED PEAK IN AGGREGATE ACTIVITY, ALL-INCLUSIVE SAMPLE						
74	Sep. 1929	56	59	50	93	86	100
46	Aug. 1937	60	57	67	93	100	88
35	June 1920	43	55	55	77	80	75
23	Sep. 1923	56	67	66	80	71	88
9	Oct. 1926	50	48	50	87	100	75
20	Feb. 1949[c]	59(83)	90	61	71	75	100
n.a.	Oct. 1953[c]	70(65)	88	58	76	62	100
	RANK CORRELATION COEFFICIENT, DIFFUSION AND AMPLITUDE[d]	+.5	+.4	+.1	+.6	+.1	+.7
	PERCENTAGE CONTRACTING: FIFTH MONTH FOLLOWING INDICATED PEAK IN AGGREGATE ACTIVITY, ALL-INCLUSIVE SAMPLE						
74	Nov. 1929	84	70	57	100	100	100
46	Oct. 1937	84	86	74	100	100	100
35	Aug. 1920	40	91	61	79	83	75
23	Nov. 1923	38	60	63	53	14	88
9	Dec. 1926	60	71	49	100	100	100
20	Apr. 1949[c]	76(73)	81	69	81	88	100
n.a.	Dec. 1953[c]	89(69)	88	50	60	38	62
	RANK CORRELATION COEFFICIENT, DIFFUSION AND AMPLITUDE[d]	+.7	+.1	+.3	+.3	+.3	+.2

SOURCE: See Table 8.2.

[a] See Table 8.3.

[b] Figures in parentheses are for components of revised (Dec. 1953) FRB index of industrial production.

[c] The peak dates, November 1948 and July 1953, are based on the business cycle chronology (see Table 8.2).

[d] Based on 5 contractions, 1920–1938.

data giving due weight to irregularly conforming series are not yet available, nor have we exhausted the available methods of smoothing out short-run fluctuations. Furthermore, careful study of different economic sectors may suggest factors upon which special emphasis should be laid for this purpose. Finally, additional tests are needed of the hypothesis that the scope of a business cycle contraction in its early stages has a significant bearing on its later development.

What then can we say, in summary, as to the value of diffusion indexes? Basically, their value lies in the fact that they provide a simple measure

of the "cumulative process" in business cycles. Since this process is one of the features that distinguish business cycles from other types of economic change, it is naturally important to observe and to measure it, historically and currently. Business cycles, according to the working definition adopted by the National Bureau, consist among other things of "expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle."[12] Diffusion indexes tell us how widespread an expansion or contraction is at any given time, and can therefore help us to judge whether the movement is of cyclical dimensions. Moreover, if a general contraction (or expansion) is under way, diffusion indexes show whether it has been spreading among different activities, institutions, or industries, or whether it has been shrinking in scope.

The value of diffusion indexes for economic analysis is enhanced by two empirical observations on their behavior. First, their movements tend to lead those in measures of aggregate activity. This we have found to be one of the most regular features of business cycles, and it means that diffusion indexes can be of assistance in identifying cyclical turns in aggregate activity. Secondly, we know that severe cyclical movements are usually more widely diffused than mild ones. Although we do not yet know whether this fact can be harnessed in some way to a forecasting scheme, it is at least of value in diagnosing the current situation and recent past.

It is perhaps not fanciful to expect, then, that by providing information pertinent to the identification and appraisal of the current stage of the business cycle, diffusion indexes will contribute to the proper timing of measures taken to combat depression or promote recovery. By the same token, they may be helpful in appraising the efficacy of such measures. Indeed, since the measures appropriate to a contraction that is widespread may differ from those appropriate when only a few industrial sectors are involved, diffusion indexes may usefully contribute to the choice of policy. As we learn how to improve upon their construction and interpretation, their value as tools for economic analysis seems likely to grow.

[12] *Measuring Business Cycles*, p. 3.